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(FAM. RHODOMELACEÆ)

BY

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During a short visit to Okha Port on the coast of Okhamandal in the State of Baroda, India, I gathered upon the flat evenly sloping sandy shore a great number of interesting Algæ cast ashore here and lying nearly dried up during ebb-tide. But in spite of this the specimens were quite fresh and in an astonishingly well kept condition. Among these Algæ I also found the plant which I propose to describe here.

The plant has a fine rosy-red colour and is much and irregularly ramified (Fig. 1). As I have found only fragments of plants, I am not able to give any information of its size nor any description of its base. In determining the size of the plant it must also be remembered that I have found only male plants which as a rule are more feebly developed than female and tetrasporic ones. The specimens found are about 5—6 cm high only, and the thickest stems about $^3/_4$ mm thick. The upper, younger parts of the thallus are all covered by soft, ramified trichoblasts up to about $1^1/_2$ mm long placed in a screw (Fig. 1); in the older parts the stems are bare, the trichoblasts having been dropped.

The plant increases monopodially by means of an apical cell (Fig. 2) from the base of which flat segments are cut off by somewhat declining walls, making the segments highest where the trichoblasts are going to develop. In

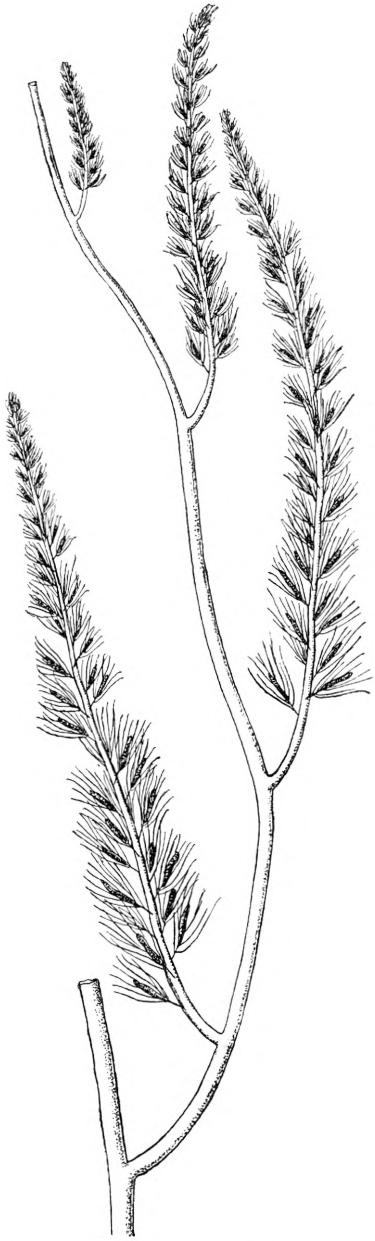

Fig. 1. *Spirocladia barodensis* Börgs. Part of an antheridial plant. (× 5).

a very early stage of development, even before the segments become divided, these begin to grow out. The trichoblasts are placed in a screw to the left with a $^1/_4$ divergence. Not until later on, when the trichoblasts have reached some size and begin to be ramified, do the segments become divided into a central and 4 pericentral cells (Figs. 2, 4). From the last mentioned cells hyphae-like filaments are early developed which run down along the furrow between the pericentral cells (Figs. 3, 9, 10); these filaments are divided by transverse walls (Fig. 5) and from these again cells are cut off which gradually grow out over the surface of the pericentral cells (Fig. 4) and in the older thallus form a dense cortical layer (Figs. 8, 9).

The trichoblasts early become divided into segments (Fig. 2) and when a few segments are formed the ramification begins. The first side-branch is developed from the second segment on its right

(anodic) side (Figs. 2, 3, 9) and soon after upon the next segment a branch is developed on the opposite side; the following branches are placed like a screw, one from each

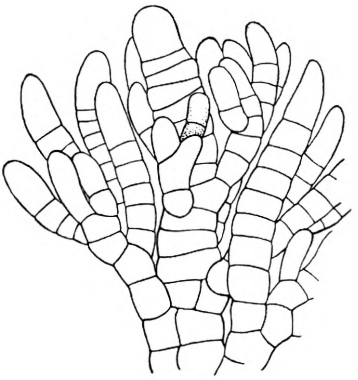

Fig. 2. *Spirocladia barodensis* Börgs. Apex of the thallus with young trichoblasts. (About 500 × 1).

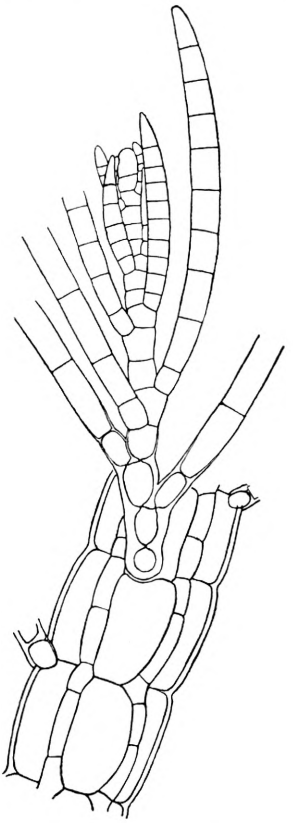

Fig. 3. *Spirocladia barodensis* Börgs. Part of a young branch with incipient development of the cortical layer and a young trichoblast. (About 250 : 1).

segment with a $^1/_4$ divergence (Figs. 1, 3, 6, 8). In the trichoblasts which do not become fertile the main stem as well as the branches remain monosiphonous. The main stem continues its growth for some time until a number of segments (about 20) are formed. During the growth the segments become lengthened to about 4 times their breadth in the branches, lesser in the main axis, while the basal segment remains short.

In the basal part of the fertile trichoblasts (Fig. 8) a number of segments remain sterile, in most cases 8—10—12 according to their vigour, each carrying a long side-branch

with the exception of the lowermost segment; then the fertile part of the trichoblast begins. In this the segments become divided first into a central and 4 pericentral cells (Fig. 6). The last mentioned again become divided by radial and tangential walls into a number of smaller cells forming a dense cover round the central axis in the middle

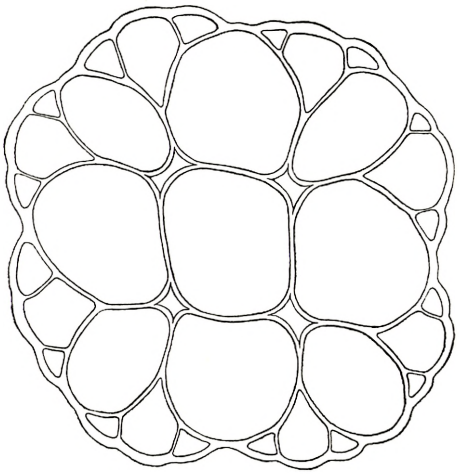

Fig. 4. *Spirocladia barodensis* Börgs. Transverse section of the thallus showing the central and four pericentral cells surrounded by a cortical layer taking its rise from hyphæ-like filaments developed in the furrows between the pericentral cells. (About 300 : 1).

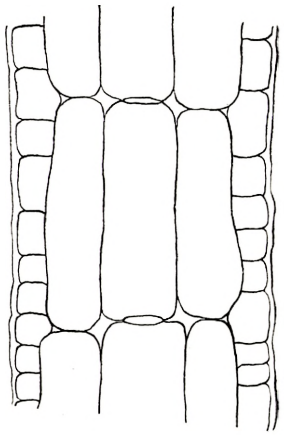

Fig. 5. *Spirocladia barodensis* Börgs. Longitudinal section of the thallus showing the central and pericentral cells and the cortical layer. (About 100 : 1).

(Fig. 7). A longitudinal section shows that the axis is composed of oblong-roundish cells. When fully developed the peripheral cells are the antheridia from which the spermatia are formed.

The fertile part (Fig. 8) has the shape of a long cylindrical body and consists of a great number of segments from each of which, as in the sterile part, lateral branches

issue, placed in a screw line. As said above, in most cases the segments in the main stem below the fertile ones remain undivided; but now and then it happens that a few of the segments below the fertile part become polysiphonous, and in rare cases in very vigorous trichoblasts the stem may become polysiphonous throughout, with the exception of the two lower-most segments which I have always found undivided (Fig. 9). Furthermore in such vigorous trichoblasts it happens that some of the lateral branches placed below the fertile part also become fertile; I have counted up to 7 fertile side-branches in one trichoblast; the axes of these branches become polysiphonous and ramified like a screw in the same way as in the principal axis.

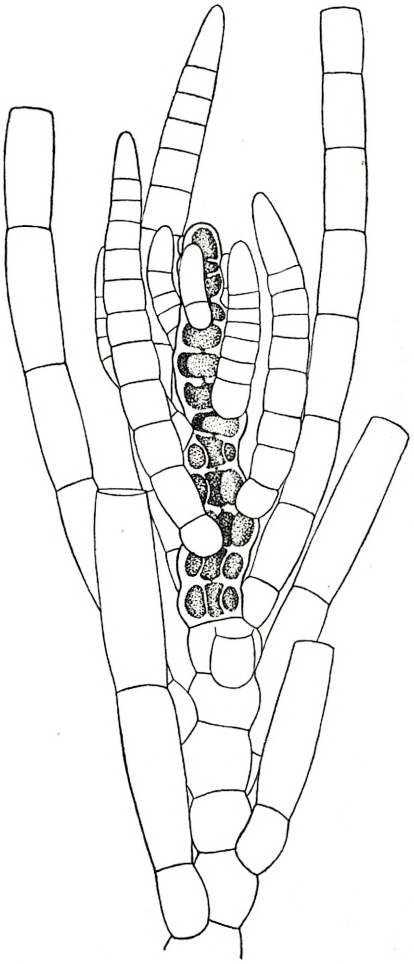

Fig. 6. *Spirocladia barodensis* Börgs. A young trichoblast becoming fertile; the lowermost segments in the fertile part beginning to be polysiphonous. (About 500 : 1).

The ramification of the plant takes place by adventitious, endogenous branches appearing here and there in the main stem at some distance from the apex of the plant (Fig. 10). I have not seen many young bran-

ches but judging from those I have seen, the branches always seem to arise from near the base of a trichoblast, being placed to the right, anodic side of it but not immediately in connection with it.

As will be clear from the above description of the Indian plant, it must naturally be referred to the characteristic and well defined group *Lophotalieæ* in the large family: *Rhodomelaceæ*.

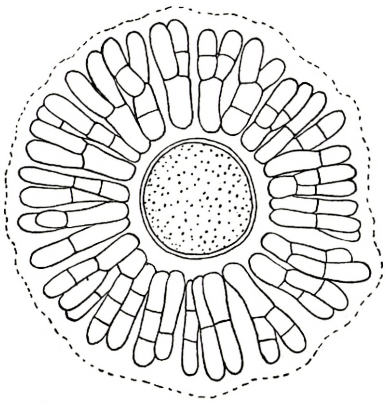

Fig. 7. *Spirocladia barodensis* Börgs. Transverse section of an antheridial body. (About 700 : 1).

Most of the forms referred to this group were formerly placed in the large genus *Dasya*. But by Schmitz's fundamental examination of some of these forms in his paper: "Die Gattung Lophotalia J. Ag." (Berichte d. deutsch. bot. Gesellsch., Bd. XI, 1893, p. 212) and later by Schmitz and Falkenberg's arrangement of the genera of the *Lophotalieæ* in Engler und Prantl, "Natürlichen Pflanzenfamilien", 1. Teil, 2. Abt. 1897, "Rhodomelaceæ", p. 445, and finally by the detailed working out of the whole family of the *Rhodomelaceæ* in Falkenberg's classic work: "Die Rhodomelaceen des Golfes von Neapel" (Fauna und Flora des Golfes von Neapel, 25 Monographie, Berlin 1901, p. 533), the rather varying, but nevertheless in several respects closely related, forms of this group have been placed in well defined genera.

When I first examined this plant I thought it must be referred to the genus *Doxodasya*. This genus has the

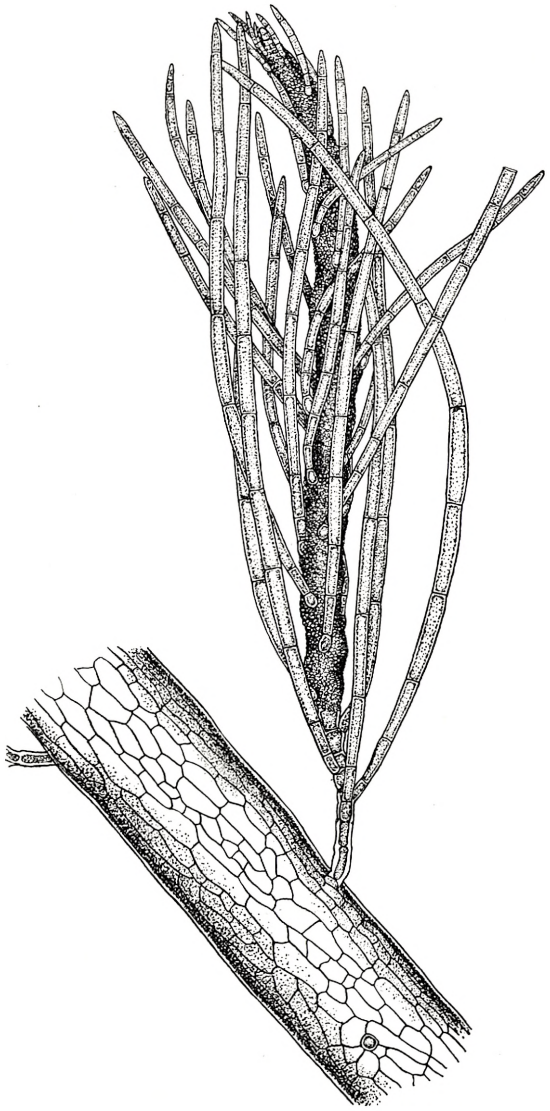

Fig. 8. *Spirocladia barodensis* Börgs. A trichoblast with a fully developed antheridial body showing the spirally placed ramuli also in the fertile part. (About 80 : 1).

same monopodial way of growing; the segments are divided into a central and 4 pericentral cells which early become

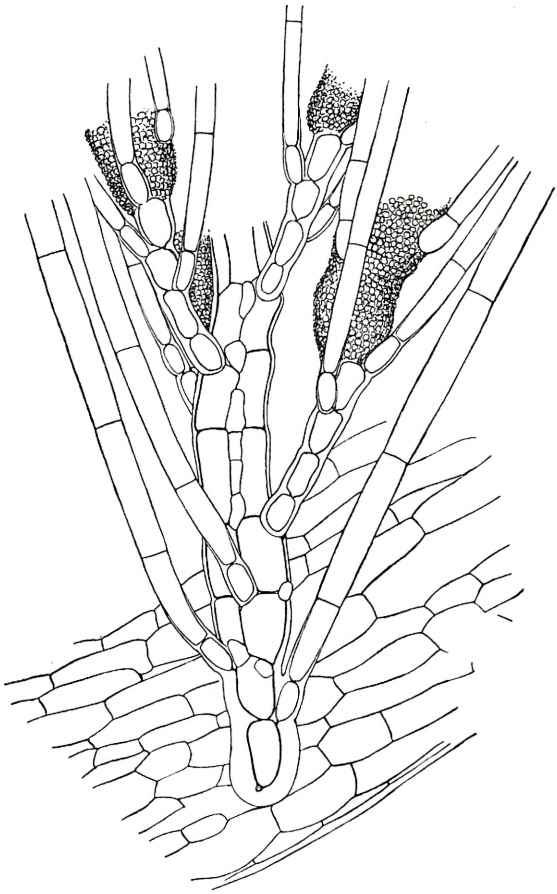

Fig. 9. *Spirocladia barodensis* Börgs. Basal part of a vigorous trichoblast in which besides the main axis four of the ramuli have become fertile. With the exception of the three lowermost segments (the basal one is not visible) the non fertile segments in the main axis have become polysiphonous and even an incipient development of the cortical layer has taken place. (About 170 : 1).

covered with a cortical layer developed by hyphae-like filaments; the lateral organs are placed in a screw-line and

the branchlets of the side-organs are likewise placed in a screw-line, and in the fertile part of these, branchlets are also developed. All this agrees very well with my plant and to this must be added that the appearance of the two plants also is very similar; compare HARVEY's figure of *Dasya bulbochaete* Harv. in "Nereis Australis" tab. XXV and KÜTZING's in "Tabulæ Phycologicæ", vol. XIV, pl. 65, with my Fig. 1 showing the habit of the Indian plant.

But when examined in more detail, very essential differences are nevertheless present. The following short description of the development of the thallus of *Doxodasya* is of course especially based upon the detailed description of FALKENBERG, but I have also been able to compare my plant with a very fine collection of *Doxodasya* belonging to the Kew Herbarium.[1]

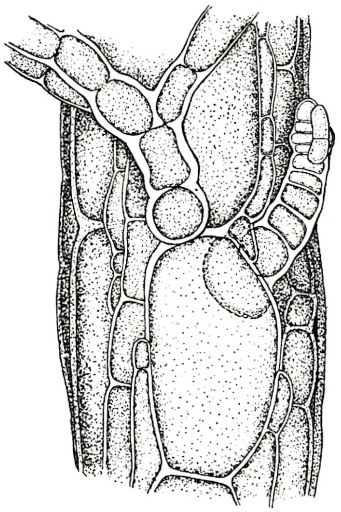

Fig. 10. *Spirocladia barodensis* Börgs. A branch (long-shoot) is about to be developed near the base of a trichoblast at the right side of it. The cortical layer is beginning to be developed on the main stem. (About 350 : 1).

It is especially the development of the lateral organs which differs very much from the much more simple structure of the trichoblasts in my plant.

According to FALKENBERG, a monosiphonous lateral organ is first formed; when this is quite developed and its cells begin to be lengthened, an axillary shoot, as FALKENBERG calls it, is formed upon its second or third seg-

[1] I here tender my cordial thanks to Sir ARTHUR HILL, Director of the Kew Gardens, for the permission to borrow this fine collection.

ment and at the same time the two or three basal segments of the primary branchlet becomes polysiphonous, thus being the reason why Falkenberg also considers it a branch. These axillary shoots develop in different ways. In rare cases they may grow out into long shoots from which the ramification of the plant originates. But in most cases they remain as short branches. When these remain vegetative, 4 to 8 monosiphonous segments are formed, from each of which long monosiphonous side-branches issue placed in a screw. On the other hand, when they become fertile (tetrasporic; antheridial plants have not yet been recorded in this genus) the segments in the fertile part become polysiphonous; in the non-fertile part the axis of the axillary shoot remains in some cases monosiphonous, in others hyphae are developed to strengthen it, and in yet other cases it becomes polysiphonous with 4 pericentral cells and furthermore covered more or less by hyphæ. This development must be said to differ highly from that of the Indian plant. Thus the basal segments in the axis of the trichoblasts in the Indian plant always remain undivided, monosiphonous, without development of hyphæ. And furthermore no axial shoot formation as in *Doxodasya* is found in my plant where the development of the trichoblast[1] takes place by monopodial growth. And finally the development of the branches differs greatly in the two plants. On account of these facts our plant cannot be placed naturally in this genus.

And still less it can be referred to any of the other

[1] In the description above of my plant I have designated the lateral organs in the Indian plant as trichoblasts and not as shoots. Regarding this question I refer the reader to my remarks in "The marine Algæ of the Danish West Indies", vol. II, Copenhagen 1915—20, p. 309, where also literature concerning this matter is quoted.

genera belonging to the group *Lophotalieæ*. For comparison I shall shortly mention the main characters of the genera referred to this group according to FALKENBERG's monograph.

Thus *Lophotalia* has 5 pericentral cells and the trichoblasts are unbranched and as a rule monosiphonous, though with the exception of the basal segment, which sometimes becomes polysiphonous.

Brongniartella, in the various species referred to it, has a varying number of pericentral cells; in its way of growing it is rather like *Polysiphonia*, axillary shoots being developed from the basal cell of the trichoblasts.

Lophocladia has 4 pericentral cells: the trichoblasts have the branchlets arranged fan-like in one plane and the stichidia and antheridial bodies originate from the first side-branch of these. Compare also my description and figures of *Lophocladia trichoclados* (Mert., C. Ag.) Schmitz; BÖRGESEN, l. c. pp. 302—310, figs. 304—12.

Wrightiella has 4 pericentral cells and the trichoblasts have the branches placed in a screw; in the main axis of the trichoblasts the screw shaped stichidia are formed. And in this genus adventitious endogenous branches are formed in great numbers, some of which grow out to long shoots, but most of them remain short as spine-like branchlets. Regarding *Wrightiella Tumanowiczii* (Gatty) Schmitz compare also my description and figures, l. c. p. 310—313, figs. 313—317.

In this group FALKENBERG further includes the 3 genera *Pteronia*, *Murrayella* and *Holotrichia*. These are all in various ways different from the Indian plant and upon the whole also rather different from the genera mentioned above, and may therefore be left out of consideration here.

On the basis of the above mentioned facts I am therefore of opinion that the Indian plant cannot be referred to any of the hitherto recorded genera of this group in the Fam. *Rhodomelaceæ*, and although I have been so unfortunate to have found only antheridial specimens, I nevertheless have no hesitation in considering the Indian plant as a representative of a new genus for which I propose the name *Spirocladia*. Because of its in a screw-line ramified trichoblasts it comes nearest to *Wrightiella* and *Doxodasya*.

Spirocladia Boergs. gen. nov.

Thallus cæspitosus, irregulariter ramosus, teretiusculus, articulatus, articulis polysiphoniis e cellulis centralibus et 4 pericentralibus æqve longis compositis, hyphis sensim corticatis, in parte juniori trichoblastos coloratos spiraliter ordinatos gerens, ad basim nudus.

Thichoblasti articulati, monosiphonii, spiraliter ramosi, ramellos ex omnibus segmentis (basali excepto) emittentes, axi centrali fere ex 20 segmentis composito.

Ramificatio plantæ per ramulos adventitios endogenos fit. Rami prope basin trichoblastorum et ad dextram partem eorum oriuntur.

Antheridia in axi centrali tricboblastorum formantur, segmentis fertilibus polysiphoniis sensim in cellulas minores divisis; segmentis basalibus trichoblastorum fertilium plerumque monosiphoniis, interdum polysiphoniis exceptis segmentis duobus basalibus, quæ semper monosiphonia manent. Tetrasporangia et cystocarpia ignota. Color coccineo-purpurascens.

Spirocladia barodensis Boergs. sp. nov.

Frons 7—8 cm alta et ultra? Rami adulti ca 1 mm lati. Trichoblasti ca 2 mm longi.

Ramelli trichoblastorum cylindrici, ca. 1,5 mm longi et 35 μ crassi, in parte basali thalli interdum moniliformes ex cellulis oblonge-ellipticis ca. 60 μ crassis compositi.

Corpuscula antheridiorum cylindrica ad 1 mm longa, et 70 μ crassa.

India: Okha Port, cast ashore, BØRGESEN 5551 and 5562.

I wish to thank Miss INGEBORG FREDERIKSEN and stud. mag. ALLAN SJØDAL for their valuable help in producing the figures.

LIST OF LITERATURE

Börgesen, F., The Marine Algæ of the Danish West Indies, vol. II, Rhodophyceæ, Copenhagen 1915—20.

Falkenberg, P., Die Rhodomelaceen des Golfes von Neapel und der angrenzenden Meeres-Abschnitte. Fauna und Flora des Golfes von Neapel. Herausgegeben von der Zoologischen Station zu Neapel. 25. Monographie. Berlin 1901.

Harvey, W. H., Nereis Australis or Algæ of the Southern Ocean. London 1847—49, tab. XXV.

Kützing, Tabulæ Phycologicæ. Vol. XIV, pl. 65.

Oltmanns, Fr., Morphologie und Biologie der Algen. Zweite, umgearbeitete Aufl. Zweiter Bd., Jena 1922, p. 313 and 405.

Rosenvinge, L. Kolderup, Sur les organes piliformes des Rhodomelacées. Oversigt over det Kgl. danske Videnskabernes Selskabs Forhandlinger, 1903, no. 4.

Schmitz, Fr., Die Gattung Lophotalia J. Ag. Berichte der deutsche bot. Gesellschaft, Bd. XI, 1893, p. 212.

Schmitz, Fr. und P. Falkenberg, Rhodomelaceae in A. Engler und K. Prantl, Die natürlichen Pflanzenfamilien. 1. Teil, Abt. 2. Leipzig 1897.

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